VEHICLE AIR CONDITIONER

[Technical Field]

This invention relates to a vehicle air-conditioner and, more particularly, to a vehicle air-conditioner that is operated before the vehicle moves.

[Background of the Invention]

Conventionally, it is known to perform preliminary air-conditioning in vehicle and a vehicle air conditioner is started before the driver or passenger (hereinafter referred to the driver) enters the vehicle. For example, preliminary air-conditioning is described in Japanese Patent Publication No. 3,287,110.

Preliminary air-conditioning is frequently performed in the summer. The air conditioner is operated, by receiving the starting signal from a driver's transmitter, to lower the temperature of the cabin to a comfortable level by the time the driver enters the vehicle.

In order to make the cabin temperature comfortable, it is necessary to strongly cool the cabin for a long time. When the interval from the air-conditioner starting time to the driver entering time is short, interior equipment such as a steering wheel, a seat and so on can still be hot. Therefore, when the driver enters the vehicle, contact with hot interior equipment may make him uncomfortable. Furthermore, the temperature of the instrument panel be reduced easily and the radiant heat emitted from the instrument panel can undesirably affect the driver.

[Summary of the Invention]

In view of the above-mentioned problem, one object of this invention is to effectively lower the temperature of interior equipment in a vehicle during preliminary air-conditioning.

The other object of the invention is to make the

driver comfortable when he enters the vehicle.

The present invention is directed to a vehicle air conditioner in which airflow from an air outlet can be controlled to directly lower the temperature of the interior equipment before a driver enters the vehicle.

In one aspect of the invention, an air outlet is placed in the interior equipment.

In another aspect of the invention, an air outlet is placed against the interior equipment.

Further, the interior equipment can be, for example, an instrument panel, a steering wheel or a seat.

Furthermore, an air-conditioner operating time can be controlled, based on a setting time of a timer or a temperature detected by a sensor. The sensor may be a sensor used for an ordinary vehicle air-conditioning control system or cabin environment control system.

Furthermore, when a driver enters the vehicle or the engine starts, the airflow is stopped or is changed to a regular air-conditioning airflow.

Thus, the temperature of an interior equipment can be effectively lowered before the driver enters the vehicle, and the driver does not experience discomfort. That is, the airflow can intensively cool the interior equipment that has a high-load. Preliminary air-conditioning of the cabin can thus be efficiently performed.

[Brief Description of the drawings]

This invention will now be explained in further detail, with reference to the enclosed drawings of which:

FIG. 1 shows a schematic illustration of airflow from air outlets during preliminary air-conditioning of an embodiment according to the present invention; and

FIG. 2 shows a flow diagram of control of the air-conditioner of an embodiment according to the invention.

[Description of Preferred Embodiments]

Arrows of FIG. 1 show the airflow, from air outlets, which is generated by the vehicle air-conditioner.

Interior equipments to lower temperatures by the preliminary air-conditioning, are, for example, an instrument panel 1, a steering wheel 2 or seats 3 (a front seat 3a and a back seat 3b).

In FIG. 1, the air outlets are arranged on top and front of an instrument panel 1, backrests of seats 3, an interior part facing a backseat 3b, a ceiling board and a door. It is realized that a person skilled in the art can arrange various air outlets in any desired place in vehicle. The airflow from the air outlets of top of the instrument panel 1 is indicated as the airflow 10, the airflow from the air outlets of front of the instrument panel 1 is indicated as the airflow 20, the airflows from the air outlets of the seats 3 (the front seat 3a and the back seat 3b) are indicated as the airflows 30 (the airflow 30a and the airflow 30b), the airflow from the air outlets of the part facing a backseat is indicated as airflow 40, the airflow from the air outlets of the ceiling board is indicated as the airflow 50 and the airflow from the air outlets of the door is indicated as airflow 60.

The airflow 10 can lower the temperature of the top of the instrument panel 1 itself. Furthermore the airflow 10 can hit the windshield to lower the temperature of the windshield.

The airflow 20 can lower the temperature of the front of the instrument panel 1 itself. Furthermore the airflow 20 can hit the steering wheel 2 and the front seat 3a to lower the temperature of the wheel 2 and the seat 3a.

The airflows 30 can lower the temperature of the seats 3 themselves. Furthermore the airflow 30a hits the steering wheel 2 to lower the temperature of the steering wheel 2. The airflow 30b hits the back of the front seat 3a to lower the temperature of the front seat 3a.

The airflow 40 hits the back seat 3b to lower the temperature of the back seat 3b.

The airflow 50 lowers the temperature of the ceiling board itself. Furthermore the airflow 50 hits the instrument panel 2, the steering wheel 3, the seats 3 and the windows such as a windshield 7 to lower the temperature of the instrument panel 2, the wheel 3, the seat 3, the windshield 7 and so on.

The airflow 60 lowers the temperature of the door and hits the window of the door to lower the temperature of the window.

When the airflows are defined as mentioned above, the interior equipments are cooled efficiently. Namely, the instrument panel 1 an the seats 3 reach low temperatures by having air outlets for the airflows 10 to 30. Furthermore the instrument panel 1 is cooled by the airflow 50. The seat 3a is cooled by the airflows 20, 50 and 30b. The seat 3b is cooled by the airflows 40 and 50.

The steering wheel 2 is cooled by the airflow 20 and 50 that is arranged to blow against the wheel. If the air outlets are arranged on the steering wheel 2, the air outlets can lower the temperature of the steering wheel 2. Furthermore some of the air outlets, which are arranged on the front of the instrument panel or the ceiling board, can be the movable ports to face the steering wheel or be concentrated ports for the steering wheel.

The air outlets can be only arranged for the airflow 10, 20 and 30 to intensively lower the temperature of the instrument panel 1, the steering wheel 2 and the seats 3 of which the radiant heats affects strongly the driver.

Fig. 2 is a flow diagram that shows control of the air-conditioner of an embodiment.

First, before a driver enters a vehicle, the air conditioner starts to operate by a starting signal, which can be transmitted by the driver from outside the vehicle, using a vehicle key with a transmitter, or

communication terminal, such as a cellular phone, a personal digital assistance (PDA) and so on. Alternatively, the starting signal can be supplied from a timer attached to the vehicle.

At step S1, a preliminary air-conditioning starting signal is detected. Then, at step S2, a timer starts to count the operating time of the air-conditioner.

At step S3, it is determined that the driver has entered the vehicle or the engine (E/G) has started. The driver can be detected by the signal generated from the driver sensor that is placed in the seat, or the door sensor that detects opening and closing of a door. If the driver is in the vehicle or the engine is running, the air-conditioner cannot be activated for the preliminary air-conditioning.

At step S4, as the driver is not in vehicle and the engine is not running, the air-conditioner is activated.

At step S5, it is determined whether or not the operation time of the air-conditioner exceeds the set time. If the operation time is more than the set time, the air-conditioner is stopped. If the operation time is within set time, the control program returns to step S3 and the preliminary air-conditioning is continued.

In this example, when the driver is in vehicle or the engine is running, the air-conditioner is topped or powered off. However, the air-conditioner can be operated successively, without turn-off, as a regular air-conditioning system.

A timer is used to set up the preliminary air-conditioning operation time in this example. Otherwise, the operation time may be defined by the temperature signal obtained from a temperature sensor, which can measure the surface temperature of the interior equipment. That is, when the temperature of the interior equipment is lower than the set temperature, the air conditioner can be sopped. The temperature sensor can be a contact temperature detector, such as a thermocouple

thermometer, a thermistor thermometer and so on, or any of non-contact temperature detector, such as an infrared sensor. The infrared sensor can be a sensor currently used for a vehicle air-conditioning control system or a cabin climate control system.